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ATLS: CATHETER AND TUBE PLACEMENT

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1054

MPG28328

TEST OBJECTIVE:

Evaluate the equipment and procedures for performing medical procedures during microgravity.

TEST DESCRIPTION:

The specific objectives of this experiment are: 1) to evaluate the rack-mounted equipment and medical supplies necessary for medical procedures; and 2) to evaluate the attachments, mounting points, and inner drawer assemblies for the medical supplies; and 3) evaluate the procedures for performing medical scenarios. The resources available in the HMF mini-racks include to accomplish medical scenarios/procedures include: 1) medical equipment mounted in the racks; 2) a patch panel with places to attach tubing and catheters; 3) self-contained drawers full of critical care medical supplies; and 4) an ALS "backpack" for deploying supplies. The attachment lines, tubing and associated medical supplies, will be deployed and utilized with the equipment and a patient mannequin. Data collection is provided by direct observations by the inflight experimenters, and analysis of still and video photography.

EQUIPMENT AND CONFIGURATION:

Two mini-racks (19"x30"x48")

- Central supply drawer located near the top of the rack
- Drawer with the ALS pack and tubing located at the bottom of the rack

- Patch panel with connections for suction and oxygen tubing located near the bottom of the rack

HMF prototype Medical Restraint System

Patient Mannequin with capability to simulate insertion of:

- Foley catheter
- Naso-gastric tube
- Endotracheal tube

(See Figure 1 for a graphical depiction of the configuration)

DATA ACQUISITION:

- In-flight written questionnaires
- Self report post-test
- Still and video photography

EXPERIMENTER INFORMATION:

John Gosbee (JG)	Male	6'1"	165#
Debra Krupa (DK)	Female	5'5"	115#
Larry Pepper (LP)	Male	5'11"	155#

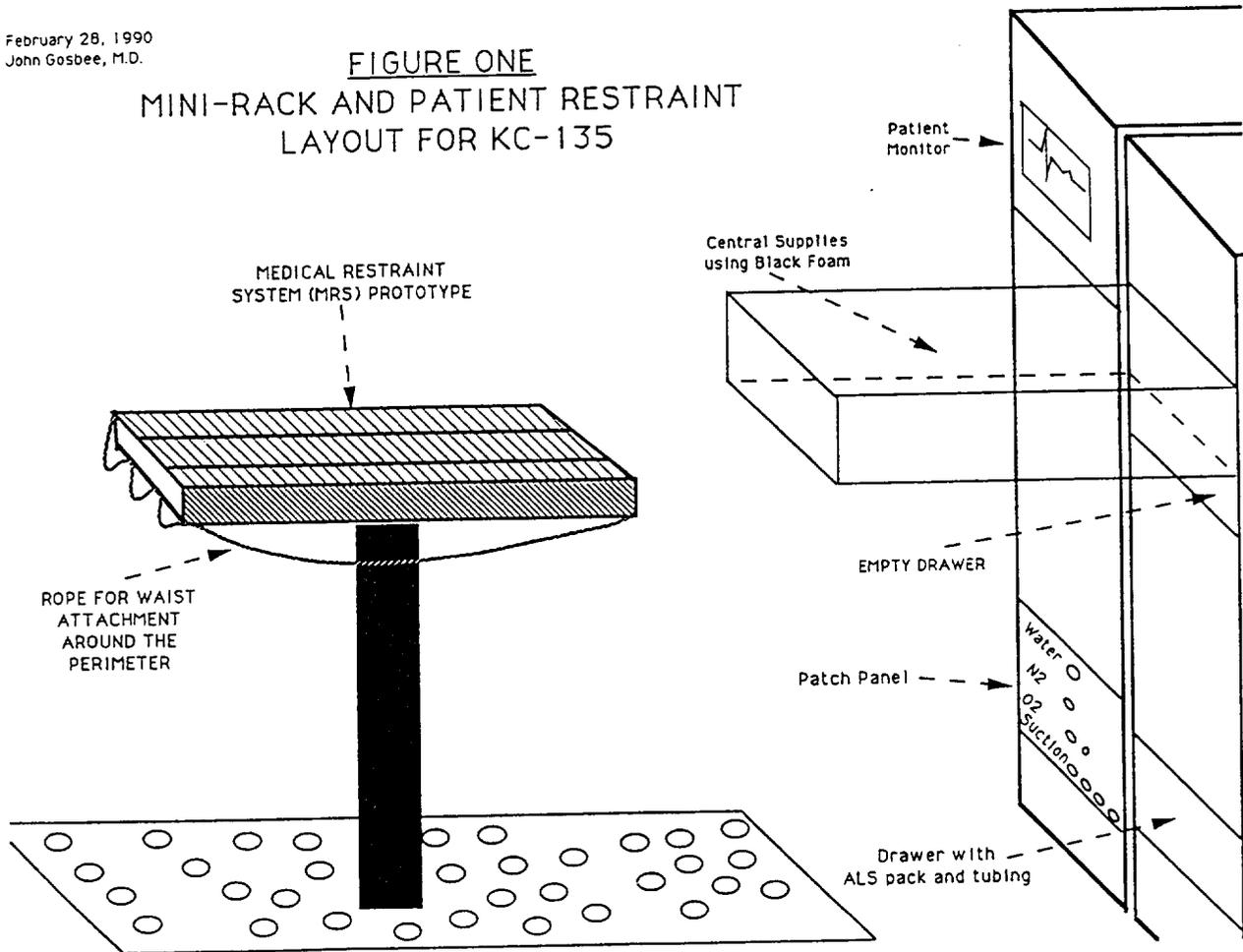
IN-FLIGHT TEST PROCEDURES AND ASSOCIATED RESULTS:

Names and locations of CMO's for first 1 3/4 procedures:

DK is Chief CMO, on near side of MRS with Swiss seat waist restraint or using ad hoc restraints in front of the racks (e.g. using one hand, or a short tether)

February 28, 1990
John Gosbee, M.D.

FIGURE ONE
MINI-RACK AND PATIENT RESTRAINT
LAYOUT FOR KC-135



JG is Asst. CMO, on far side of MRS with Swiss seat waist restraint

1. DK destows a sharp trash container, hands it to JG to deploy on far side of MRS

DK "cheated" in deploying this from behind the Patient Monitor. Otherwise it was easy to handle, and for JG to fix between the rope and the edge of the MRS.

JG 9

2. DK destows the soft trash container and deploys on near side of MRS with JG's assistance. Since DK's restraint at low altitudes was poor, and she only could use one hand, JG had to assist from underneath.

JG 5

FOLEY CATHETER

1. Both CMO's put on sterile gloves, DK first since she won't stay sterile. DK had to use one hand to restrain herself in front of the racks to disengage and open the drawer.

Having one CMO hold the opened packet of gloves was necessary for the other to aseptically put them on. The CMO has to place one hand on the finger tip end and one hand holding the folded paper open.

JG 7 (if there is enough time, and both CMO's know the proper technique)

2. DK destows, opens and presents a FREPP to JG, who uses it to prep the area, and then hands the FREPP to DK for disposal

DK had to twist and stretch to her limit to disengage the drawer, and open it. Once open, one FREPP could be fairly easily removed, opened, and presented to JG in an aseptic fashion.

JG 8

3. DK destows, opens, and presents the Foley catheter to JG; DK disposes the overwrap.

DK had to twist and stretch to her limit to open the drawer; but stretched

less once the drawer is opened up and closer to the MRS. No problem destowing or presenting the Foley. However, DK had to be real careful to not let any unsterile part of the overwrap, or her arms touch the sterile Foley that JG was extracting.

JG 6

4. DK destows Foley tube and bag, and attaches tube to Foley catheter, and bag to edge of MRS

DK could easily reach these items in the now extended drawer, but decided to extract several items at once (like a squirrel), and place them under bungees near the mannequin legs for easy access. JG had to give the Foley catheter end to DK, who then attached it the tube and bag, which was accomplished easily, since both DK and JG were well restrained and could use both hands. The overwrap for the Foley bag did not fit into the soft trash container, and was difficult to bend or crush in an attempt to do so.

JG 8

5. DK destows the water-filled Foley syringe, and checks the Foley balloon on the catheter.

Upon removal of the syringe from its overwrap, water was sprayed out. DK had to grab the Foley catheter end, because JG and DK couldn't line them up.

JG 8, if DK grabs both the syringe and the catheter end.

6. DK destows the KY jelly, JG covers the end of the Foley catheter with jelly, inserts into urethra of mannequin, and DK blows up balloon.

It was almost impossible for JG to maneuver the sterile tip of the Foley into the small opening of the KY jelly packet, which DK was holding. In fact, the tip touched the outer edge of the packet and became "unsterile". This was due to fine tremors in both hands, and some unsteadiness in the CMO restraint mechanisms. (Another method for doing this procedure is required!)

JG 2

7. DK destows generic plastic tubing and attaches one end to low intermittent suction on the patch panel, and the other end of Foley bag.

The tubing was located in a drawer near the floor, as was the patch panel. Since DK had to release from the MRS to access these two areas, she had to restrain herself with only one hand. This method was unsteady and uncoordinated, so extraction of the tubing was slow, and dislodged other items in the drawer; and attaching the tubing to the patch panel was slow and the tubing wasn't attached very well. In addition, the velcro strips that held down the cover used to hold items in the lower drawer was almost impossible to put back into place properly.

JG 3 destowing tubing
JG 8 attaching tubing to Foley
JG 4 attaching tubing to patch panel

OVERALL COMMENTS:

More intensive one-g practice, and/or more parabolas to accomplish certain tasks, may have made the above tasks easier to accomplish in microgravity.

Some tasks above were abbreviated, or accomplished in the 2-g portion of flight in the interest of time (e.g., putting on gloves, repositioning some loose items).

Since adequate restraint mechanisms for a CMO in front of the racks have not been identified or evaluated, ad hoc methods were attempted by DK with very limited success.

NASO-GASTRIC (NG) TUBE

1. ALS pack is destowed, opened, and bungeed to the end of the MRS

Since the ALS pack was in the back of the low drawer, DK again had difficulty opening the drawer, opening the velcroed cover, and extracting the pack. In fact, DK opened the entire cover, but the other items in the drawer were wedged into place and did not float out.

Placing and restraining the ALS pack over the legs of the mannequin required both DK and JG. Several items that were loosely held down inside the pack floated loose during the deployment. Since there was no labels or color code cues, it was difficult to replace loose items, and good restraint areas of the pack got "filled" up quickly with several disparate items. Bob Williams made a very astute comment: "its too busy, you can't find things, or remember where to restow them".

JG 5

2. DK destows tape from drawer, hands to JG, who tears long piece of tape

Similar problems to those above. This cloth tape tended to "stick" to the black foam, and was hard to remove from the drawer.

JG 6

3. DK destows a generic piece of tubing, attaches one end to the suction port on the patch panel, and holds the other end near the patient head.

Again, the access to the lower drawer and patch panel was difficult, but there was some decrease in those difficulties with practice.

JG 4

4. DK destows the NG tube, unwraps it, and hands it to JG. DK disposes overwrap material.

No real problem with the upper central supply drawer extended. Again, DK removed several items, including some listed below, and placed them under bungees located over the mannequin's legs.

JG 8

5. DK destows the 60cc syringe, and hands to JG, who attaches it to the NG tube

No problems noted. JG 8

6. DK destows KY jelly, JG covers end of NG tube with jelly

Since the NG tube does not have to be sterile, DK could hold both the KY packet and the NG tube tip at the same time. Thus, there was no difficulty accomplishing this procedure.

JG 9

7. JG inserts tube into nares of mannequin

Since JG had solid waist restraint, this two-handed procedure was no more difficult than in one-G. JG 10

8. DK tapes NG into place.
LP takes DK place on the near side of the MRS from the racks.
DK takes JG place on the far side of the MRS from the racks.
9. LP destows a stethoscope from the ALS pack. Difficulty finding this, since it was in an opaque zippered pocket

JG 7

10. LP attaches NG tube to generic suction tubing, and then to the patch panel. Suction turned on and set at low intermittent on patch panel.

Since LP is taller, and has longer arms, he is able to reach the patch panel while still attached to the MRS (i.e. restrained at the waist). Thus, this task was easier than DK was doing it.

OVERALL COMMENTS:

Since this is a clean procedure, not an sterile one, both CMO's could manipulate all items utilized, and work together. During Foley catheter insertion, JG could only touch sterile items, but not non-sterile items; and DK could not touch sterile items, but could handle non-sterile items. Therefore, this procedure was accomplished easier and faster than Foley catheter insertion.

Both LP and DK had a bit of difficulty in finding items in the upper drawer and the various areas of the ALS pack. Both had to be careful not to dislodge items loosely held underneath elastic when vigorously extracting another item.

NASAL CANNULA

1. DK destows nasal cannula oxygen tube from ALS pack
2. DK gives cannula end to LP to place on mannequin nose and head

With proper waist restraint, LP could use both hands and easily place the nasal cannula, with DK's help. JG 8
3. LP attaches other end of nasal cannula tube to oxygen outlet on patch panel, and sets the flow rate to 4 liters per minute

No problems noted in attaching the cannula. JG 7. However, there were so many tubes going from the patch panel to the mannequin that LP was getting his feet tangled when he moved from place to place around the MRS (recall that the feet pressing against the floor provides the main stabilization forces, when using the waist restraint on the MRS).

INTUBATION

1. LP destows tip suction and catheter from lower drawer and attaches one end to the patch panel suction port.

LP has some difficulty destowing and manipulating this tubing. Once attached to the panel, LP stuck the tip suction under the mannikin's left arm/shoulder, since no site for restraining this end of the suction near the patient's head had been planned or designed for.

JG 7

2. LP moves to head of table

Quite a bit of difficulty releasing the carabiner, and then reattaching it to the rope that is strung around the perimeter of the MRS.

JG 4

3. DK destows two pieces of laryngoscope from ALS pack, assembles them and hands it to LP. DK destows ET tube, 10cc syringe, and AMBU bag from the ALS pack, and gives them to LP.

SaLP first tried to hold the laryngoscope, AMBU bag, and ET tube in his hands, but found that he needed to locally restrain some of them. In fact, with LP's first attempt to intubate he forgot that he needed the AMBU bag and the suction tip ready to use.

For the second trial, LP gathered all the items under a bungee near the head of the mannequin prior to attempting the intubation.

4. LP intubates mannequin

The posture necessary for LP to visualize the pharynx of the mannequin for intubation was difficult to attain and keep. LP needed to bend down, move his lower torso away from the MRS, and then extend his neck backwards. However, his waist restraint impeded this maneuver. There is a need to rapidly access the ET tube and laryngoscope right after removing the face mask and suctioning the patient's oro-pharynx.

JG 6

5. DK attaches AMBU bag and ventilates mannequin, while LP checks for breath sounds with a stethoscope.

No real problems noted

JG 9

6. LP destows ventilator tubing and attaches one end to the "ventilator" and the other end to the ET tube.

Again, there was some problem accessing the tube and attaching it, since both the drawer and patch panel were close to the floor. There did appear to be a training effect regarding restraint during access to the lower drawers, which LP also mentioned.

JG 6

JG replaces LP near the racks
LP replaces DK on the other of the MRS

7. JG destows tape and rips off pieces. JG tapes ET tube into place, while LP holds it up.

No problem with destowing, but this cloth tape is hard to rip. Since it takes two hands to maneuver the tape, another set of hands has to hold the ET tube out of the way

JG 8

OVERALL COMMENTS:

JG was able to adequately restrain his body near the bottom of the racks. To do this he "wedged" his body the MRS and racks, by placing his upper back against the edge of the MRS surface, and feet pushing up against the racks. This maneuver required a certain amount of flexibility, and height.

CENTRAL VENOUS CATHETER PLACEMENT

1. JG destows gloves and assists LP in putting them on aseptically

Specific technique required (see above)

2. JG destows FREPPs, presents to LP, who preps left shoulder

No problems noted. JG 9

3. JG removes tape and rips six pieces (4 for drapes and 2 for IV bags)

No problems noted. JG 9

4. JG hands two one tape-edged drapes to LP one at a time. JG assists LP with laying it down on the side near LP, while DO tapes the two edges

Very hard to control all four loose edges of the drape without contamination, since LP is "sterile" and JG "dirty". It appears that packaging the drapes appropriately, and defining proper 0-G procedures could overcome these difficulties.

JG 4

5. DO removes a syringe and CV catheter, and presents them to LP aseptically.

The catheter and syringe were easy to shake out of there hard plastic containers so that LP could grab them in a sterile fashion.

JG 9

6. LP mock inserts the CV catheter

The low fidelity of simulation for this particular task makes evaluation difficult. A mannequin that allows better simulation is required.

JG no comment

7. JG removes an IV bag with tubing already attached from the ALS pack, and gives it to LP.

With all the other lines and tubes next to the mannikin's head, it is difficult to find an open spot to restrain the IV bag and catheter.

NASA PHOTO REFERENCE

S90-31759 - 60

Preparation of catheter for insertion

S90-31762 - 63

Deployment of package material

S90-31766 - 67

Preparation of catheter for insertion

S90-31776 - 78

Deployment of package material

S90-31782 - 87

Deployment and usage of various tubing

S90-31792 - 93

Deployment and usage of various tubing